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The trend of sex ratio at birth in Oyo Federal Constituency, Nigeria

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Sex ratio refers to the balance between males and females in a population. Secondary sex ratio focuses on the ratio at birth, expressed as males per 100 females, and it is a demographic indicator that varies among different populations. Birth records spanning 2012-2019 from Oyo State Hospital and 2010-2019 from Ilora State Hospital were obtained and analyzed yearly and quarterly. Statistical tests (Pearson Correlation and Student's t-test) were applied to examine correlations and variations in the data. The 11,881 births recorded in Oyo State Hospital revealed a sex ratio of 101.4:100, and the 2004 births recorded in Ilora State Hospital revealed a sex ratio of 103:100, with correlation values of (0.821*) and (0.697*), respectively. The Student's t-test results (0.9014 at P>0.05) for Oyo State Hospital and (0.8307 at P>0.05) for Ilora State Hospital showed no significant difference. A declining trend in sex ratio at birth (SRB) has been observed in Oyo, whereas Ilora's SRB remains consistent with towns in neighboring states (Osun State) and some African countries. Understanding both sex ratio types aids in analyzing societal demographic trends and gender dynamics. This understanding will assist policymakers and the National Population Commission in recognizing gender disparities and the effects of prenatal care, facilitating more informed decisions.

Key words: Trend, secondary sex ratio, birth.

INTRODUCTION

Procreation is as old as the existence of man. The purpose is to preserve the species by exchanging genetic material when organisms of the same species come together. Extinction is thereby averted. The sex ratio at birth (SRB), which is also called the male proportion at birth, is an established model to evaluate the apportionment of birth frequencies according to gender (Bakare et al., 2011). Worldwide, the typical ratio of male to female births is approximately 1.05, indicating a slight yet consistent tendency for more males to be born than females (Chao et al., 2019). This global average reflects a universal biological pattern in human reproduction.

Both natural influences and human activities can alter the sex ratio at birth by affecting the period before conception or during pregnancy (Dermitzakis et al., 2025). These factors may skew the balance between male and female births, leading to changes in the SRB. Various elements, including birth order (Jacobsen et al.,

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1999), parental age (James, 1971), seasons (Nieczuja-Dwojacka et al., 2024), lifestyle choices (Dermitzakis et al., 2024a), catastrophes (Fukuda et al., 2020), chemical exposure (Dermitzakis et al., 2024b), infections (Masukume et al., 2022), and genetics, are recognized as potential determinants that can influence the secondary sex ratio (Astolfi et al., 2001).

The frequency of human sex ratio is expected to be equal at birth, as both sex cells (X and Y chromosomes) undergo segregation during meiotic division. According to genetic principles, humans should have an equal chance of male and female births, as X and Y chromosomes sort independently. This theoretically leads to a balanced primary sex ratio of 1:1 (12). This is not always feasible in cases where a particular sex is more favored in frequency than the other (Anderson and Bergstrom, 1998; Halder and Fauzdar, 2006; Azeez et al., 2007).

Though research consistently demonstrates a higher number of male births compared to female births, this trend is observed in both contemporary and historical contexts (Coale, 1991; Egan et al., 2011; Fellman, 2019). The favoritism toward one sex may be largely due to genetic factors, parental age, parental occupation, birth order, race, coital rate, environmental toxins, hormonal treatments, stress, diseases, war, maternal weight, malnutrition, maternal metabolism, and possibly seasonal variation (Cagnacci et al., 2004; James, 2004; Hesketh and Zhu, 2006; Ruckstuhl et al., 2010; Terrell et al., 2011).

Although there are some limitations, the secondary sex ratio remains a commonly utilized indicator in studies to gauge prenatal stress exposure (Grech and Masukume, 2016; Fakorede et al., 2022). This is crucial because it may reveal how local or regional challenges, such as poverty, pollution, or poor healthcare, impact pregnancy outcomes and population dynamics.

The sex ratio records obtained so far showed more males than females at birth. Globally, records have revealed a ratio of 1.07 boys to 1 girl born as at 2014 (Kaba, 2015). Reports of the annual mean sex ratio at birth in 2014 in developed countries showed 1.11 in China, 1.12 in India, 1.06 in the European Union, and 1.05 in the United States (CIA World Fact Book, 2014; Citro et al., 2014; Coney and Macke, 1998; Dama, 2011; Seth, 2010). In Africa, the sex ratio at birth as at 2008 varied: Burundi 1.03, Madagascar 1.03, Kenya 1.2, Malawi 1.01, Chad 1.04, Angola 1.05, Egypt 1.05, Tunisia 1.07, Ghana 1.03, Togo 1.03, and Nigeria 1.03, respectively (CIA World Fact Book, 2008).

The data obtained globally in 2014 showed a population of 7.174 billion people, of which 956.4 million (13.3%) under the age of 15 were males and 893.6 million (12.5%) under the age of 15 were females. In the same year, among those aged 65 and above, there were 265.5 million men and 331.2 million women. The infant mortality rate globally in the same year was 38.5 deaths per 1,000 for males and 34.5 deaths per 1,000 for females (CIA World Fact Book, 2014). The distribution is skewed toward females in later life. Male children are biologically weaker than females and are more likely to die at birth and in infancy (Milazzo, 2014).

In Nigeria, reports on infant mortality rate in 2014 showed 74.1 deaths per 1,000 for both sexes; 79 deaths per 1,000 for males and 69 deaths per 1,000 for females (Kaba, 2015). A ratio of 114 to 100 girls was reported in Ondo Town with a significant role of gender in child survival (Oyeniyi, 2012), but fluctuations in the trend of 106.0 were later observed in Ondo, 99.7 in Lagos, and 105.6 in Osun, respectively (Fakorede et al., 2022). In Ibadan, the average mean ratio observed between 1997 and 2008 was 110.1:100 (Bakare et al., 2011).

Therefore, this study seeks to provide insights into birth demographics in Oyo Town. The researcher aims to analyze birth data to reveal demographic shifts and potential factors influencing the male-to-female ratio. By examining these patterns, it is possible to better understand the societal, biological, and environmental factors that shape gender balance using data records over a period of 8–11 years.

MATERIALS AND METHOD

Oyo town is a semi-urban city in Oyo State, located north of Ibadan, the state capital, in southwestern Nigeria. It lies between latitude 7°8'33"N and 7°9'33"N and longitude 3°8'67"E and 4°0'00"E (Ufoegbune et al., 2011). Oyo town comprises four local governments: Atiba, Oyo East, Oyo West, and Afijio. The town is bounded by Ibadan in the south, Iseyin in the west, Iwo in the east, and Ogbomosho in the north.

The population is predominantly Yoruba, with minority groups including Hausa, Igbo, Fulani, and Togolese. Oyo town has two state hospitals, one in Oyo East Local Government and the other in Ilora, Afijio Local Government, both with maternity units serving pregnant women from within and outside the town.

Antenatal records, including sex of baby, delivery outcome (live or stillbirth), month, and year of birth, were obtained from the Medical Records Unit of the state hospitals. Records of all deliveries from January 1, 2012, to December 31, 2019, were obtained from State Hospital Oyo, and from January 1, 2009, to December 31, 2019, from State Hospital Ilora. The sex ratio is usually determined using a formula:

$$X/Y \times 100$$

where x represents the number of males and y the number of females. The relationship between the live and still birth sex ratio was established using Pearson's correlation test to show any potential associations. Student t-test was used to compare variations in live birth sex ratio, determining if differences are statistically significant. The data obtained were analyzed using SPSS version 20.0.

RESULTS

The data obtained from State Hospital Oyo and Ilora

Table 1. Sex ratio of data recorded between 2012-2019 in Oyo State Hospital, Oyo, Oyo State.

Year	Males	Females	Total	Sex ratio
2012	927	821	1748	112.9 :100
2013	829	1048	1877	79.1:100
2014	884	897	1781	98.6:100
2015	846	793	1639	106.7:100
2016	658	608	1266	108.2:100
2017	666	617	1283	107.9:100
2018	512	516	1038	99.2:100
2019	655	594	1249	110.3:100
Overall total	5977	5894	11881	101.4:100

Table 2. Quarterly analysis of secondary sex ratio and babies gender distribution in State Hospital Oyo.

Quarterly analysis of secondary sex ratio				
Quarter	**Male**	**Female**	**Total**	**Sex Ratio**
Jan-Mar.	1479	1352	2831	109.4:100
Apr-Jun.	1528	1599	3127	95.6 :100
Jul-Sep.	1493	1508	3001	99:100
Oct-Dec.	1479	1432	2911	103.3:100

Babies gender distribution			
Parameter	Male births (n=5977)	Female births (n=5894)	t-statistic (p-value)
Mean birth order	747.125	736.75	0.9014(<0.05)

Table 3. Secondary sex ratio data recorded between 2009-2019 in State Hospital Ilora, Oyo, Oyo State.

Year	Males	Females	Total	Sex ratio
2009	93	96	189	96.9:100
2010	125	126	251	99.2:100
2011	33	21	54	157.1 :100
2012	102	77	179	132.5:100
2013	98	87	185	112.6:100
2014	103	143	246	72:100
2015	116	95	211	122:100
2016	104	87	191	119.5:100
2017	114	93	207	122.6:100
2018	51	92	143	55.4:100
2019	78	70	148	111.4:100
Overall total	1017	987	2004	103:100

revealed 11,881 and 2,004 births (Tables 1 and 3). The secondary sex ratios of 100.04:100 and 103:100 were obtained for State Hospital Oyo and Ilora as shown in Tables 1 and 3. The highest annual mean ratio of 112.5:100 was observed in 2012 and 78.9:100 in 2013 as the lowest in State Hospital Oyo, whereas the highest annual mean ratio of 132.5:100 was observed in 2012 and 55.4:100 as the lowest in 2018 in State Hospital Ilora. From the data obtained, it was observed that the births recorded in 2012 were the highest in both State Hospital Oyo and Ilora, respectively. There was no definite pattern for the sex ratio, as fluctuations were

Table 4. Quarterly analysis of secondary sex ratio and babies gender distribution in State Hospital Ilora, Oyo.

Quarterly analysis of secondary sex ratio				
Quarter	**Male**	**Female**	**Total**	**Sex Ratio**
Jan-Mar.	249	220	469	113.2:100
Apr-Jun.	265	269	534	98.5:100
Jul-Sep.	232	208	440	111.5:100
Oct-Dec.	270	260	530	103.8:100
Babies gender distribution				
Parameter	Male births (n=1017)	Female births (n=987)	t-statistic (p-value)	
Mean birth order	92.4545	89.7273	0.8307(<0.05)	

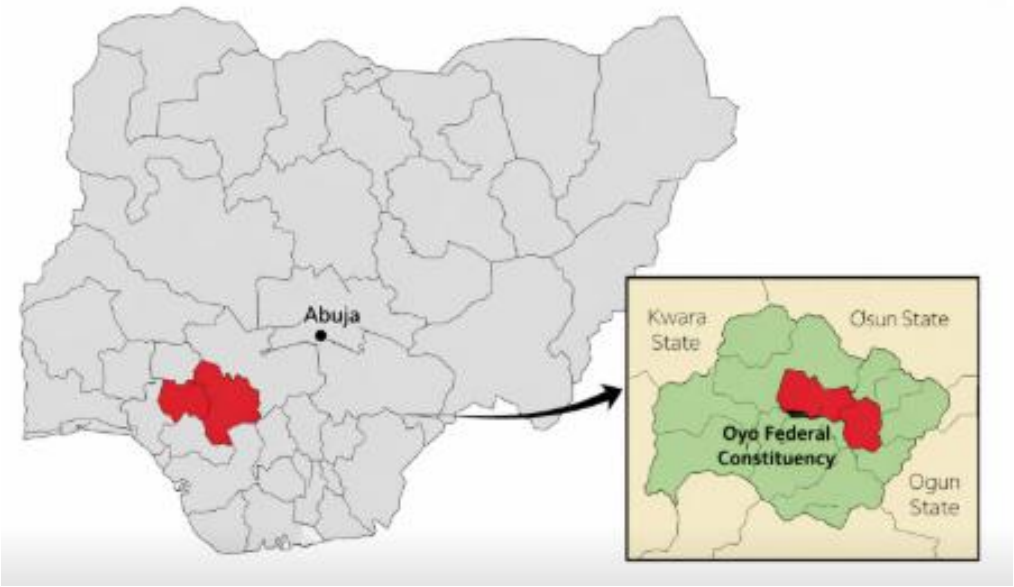

Figure 1. Map of Nigeria showing the location of Oyo Federal Constituency.

observed in total annual births. The correlation obtained for the sex ratio data from the Maternity Unit in State Hospital Oyo and Ilora revealed positive strong correlation values of (0.821**) and (0.697**), respectively. The records depict female mortality to be higher than male counterparts in Oyo and Ilora as well. The t-test values (0.9014 at P > 0.05) and (0.8307 at P > 0.05) were obtained in State Hospital Oyo and State Hospital Ilora, respectively. This shows no significant difference between the sexes. Comparatively, the mean values of 747.125 and 736.75 with standard deviations (SD) of 144.3532 and 182.3824 were obtained in Oyo, while the mean values of 92.4545 and 89.7273 with SDs of 28.1189 and 30.8645 were obtained in Ilora, respectively. Quarterly analysis from Table 2 revealed more male births between January–March and October–December in State Hospital Oyo, while Table 4 revealed more male births in State Hospital Ilora in January–March, July–September, and October–December, respectively. Figure 1 shows fluctuations in the secondary sex ratio over 8 years, with some years showing more males (2012, 2015, 2016, 2017, 2019), while others were closer to equal ratios (2014, 2018) in State Hospital Oyo, in comparison with Figure 3, which reveals more pronounced year-to-year changes in sex ratios in State Hospital Ilora. Notably, 2011 and 2012 show unusually high male-to-female ratios, while 2014 and 2018 display lower ratios. Figures 2 and 3 highlight the dynamic nature of sex ratios over time.

However, in Tables 2 and 4, the quarterly analysis shows a higher frequency of male births compared to female births during the rainy season for State Hospital Oyo,

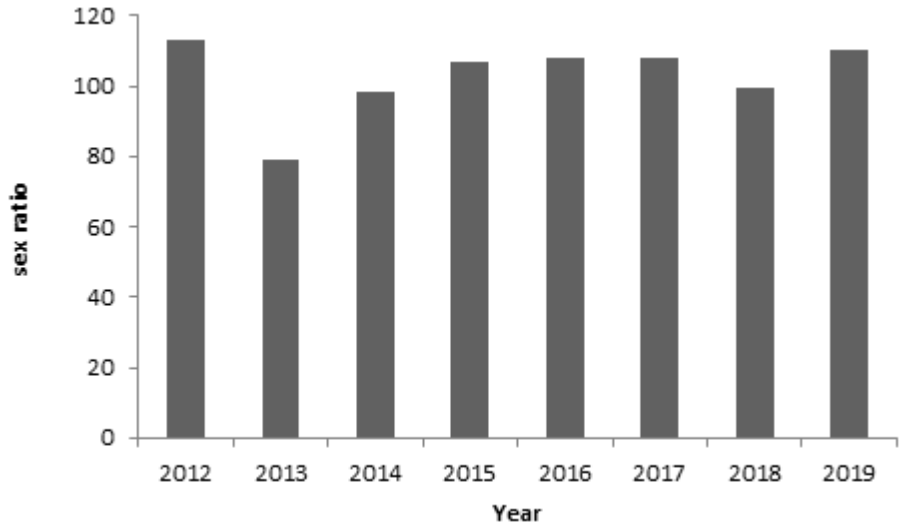

Figure 2. Yearly frequency of births recorded in State Hospital Ilora, Oyo, Oyo State.

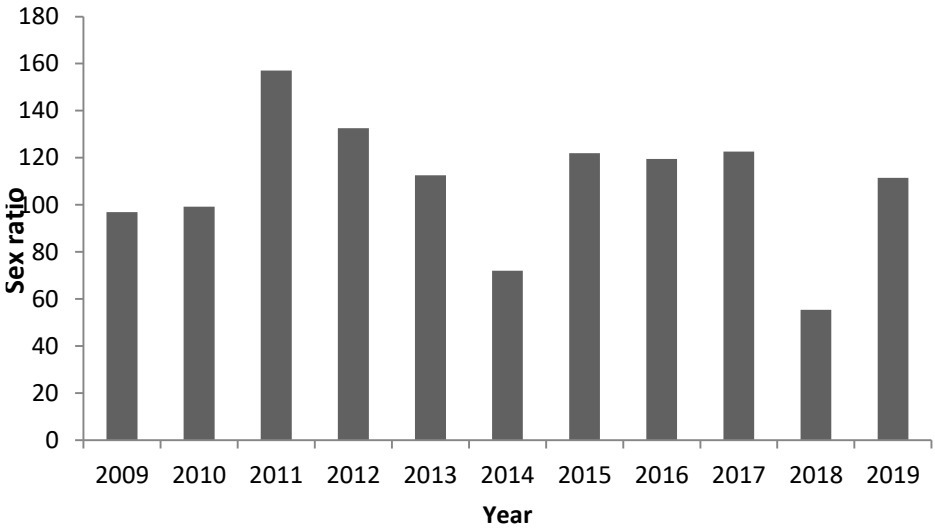

Figure 3. Monthly frequency of births recorded in State Hospital Ilora, Oyo, Oyo State.

compared to more males than females during both rainy and dry seasons for State Hospital Ilora. These overall trends suggest variability, possibly due to environmental or societal factors. These extreme variations could indicate significant events or changes impacting birth demographics during those years.

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DISCUSSION

The secondary sex ratio is a significant demographic factor which can be adopted in a specific population over a period to monitor changes in the environment and social behavior (Bakare et al., 2011). It should be noted that the data worked upon here are not the overall data from Oyo Federal Constituency, as not all birth records are secured or well-kept in hospitals or birth registries; no birth records of babies given birth at home, unwanted and abandoned (Bakare et al., 2011) are included, but this may truly represent the current status of the sex ratio in Oyo Town. The secondary sex ratios of 101.4:100 and 103:100 observed in State Hospital Oyo and Ilora are

lower than the annual sex ratio of 104:100 for the Igbos of the South-East (Egwuatu, 1984), 107–112:100 observed in Northern Nigeria (Rehan, 1982; Sule and Madugu, 2004), and 108:100 observed in Ibadan (Boroffice, 1979). The sex ratio of 103:100 observed in Ilora is consistent with selected towns in the Osun State area of South-West Nigeria (Azeez et al., 2007) and 103:100 in Burundi, Madagascar, Togo, Rwanda, Seychelles, Somalia, Tanzania, Uganda, and Zambia (Kaba, 2015). Globally, the annual sex ratio obtained is lower than 111:100 in China, 112:100 in India, 106:100 in the European Union, and 105:100 in the United States (CIA World Fact Book, 2014; Citro et al., 2014; Coney et al., 1998; Dama, 2011; Seth, 2010). Significant departures from the typical global sex ratio often indicate disturbances in ecosystems, societies, or public health. Regional and time-based differences in sex ratios are common and result from various interconnected factors, making them a complex indicator of environmental and societal conditions (Chao et al., 2019; Axarloglou et al., 2025).

The sex ratio at birth in Oyo and Ilora is unsteady, as there are seasonal fluctuations, suggesting that certain quarters of the year may have higher male birth rates in specific regions, which could be influenced by cultural, environmental, or biological factors reflecting the trends of sex ratio in Oyo and Ilora State Hospital. The results are consistent with global observations. Globally, the trend of sex ratio is erratic over decades regardless of race, ethnicity, nationality, and geographical location, whether it is due to environmental factors or nature. Japan experienced a decline in sex ratio between 1970 and 1999 from 0.5172 to 0.5135 (Davis et al., 2007); France recorded 1.05 in 2014 with no consistency with previous reports (CIA World Fact Book, 2014); 1.12–1.14 among Africans of Cameroon and Uganda (Egwuatu, 1984); and 1.03 in 2008 to 1.06 in 2014 in Nigeria (Garenne, 2008). Summarily, Nigeria's sex ratios were higher than some other African countries (>1.050) (Garenne, 2008).

Maternal age is another contributory factor favoring males at birth. The younger the mother and father are, the more likely they are to give birth to more boys, and the older they are, the more likely they are to give birth to a girl (Garenne, 2008; Kaba, 2008; Wadley and Martin, 1997). The older the paternal age, the more the sex ratio declines (Garenne, 2008), and the greater the maternal age, the more the sex ratio decreases (Wadley and Martin, 1997). In 2014, 177 million Nigerians were under the age of 15 (CIA World Fact Book, 2014), while 7.5% of females and 4% of males within the ages of 10 to 14 had married (Oyefara, 2011; Walker, 2012). [DA1.1] In comparison with the global sex ratio, the sex ratio of the total population in Nigeria was 1.026 (1,026 males per 1,000 females), which is higher than the global sex ratio of 1,016 males per 1,000 females in 2025 (United Nations Statistics Division (UNSD), 2026).

In summary, the results have shown that the secondary sex ratio in Oyo is lower than what was observed in most Southwestern states and some states in Nigeria. The results in Ilora are consistent with those observed in some towns in Osun State and some African countries, but lower than what was observed in Ibadan and Ondo Town, considering the available data at the time of collection. The decline in sex ratio in Oyo is also an issue; however, there should be further investigation into the factors responsible for the decline in sex ratio. The investigation should be further extended to cover the entire Oyo State geopolitical zone to make a juxtaposition with what is trending in Oyo Town.

Conclusion

The results in comparison with other states and regions suggests regional differences in sex ratio at birth which could stem from genetic, cultural or socio-economic factors. These findings emphasize the importance of considering geographical variations when analyzing sex ratios and their implications for population studies. Although, the data is not a complete representative of sex ratio in Oyo town as the private hospitals and trado-medical homes were not visited for data collection. This is a preliminary study and further investigations will be conducted.

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